

a gas concentration sensor having a sensor element and an electrical connector for connection to a remote digital signal processor,

said sensor element including a pump cell and a sensor cell, the pump cell being made of a solid electrolyte body and a first and a second pump cell electrode, the first and second pump cell electrodes being responsive to application of voltage to disassociate and pump oxygen molecules contained in exhaust gases of an automotive engine to which said gas concentration sensor is exposed out of said gas concentration sensor, said sensor cell being made of a solid electrolyte body and a first and a second sensor cell electrode, the first and second sensor cell electrodes being responsive to application of voltage to disassociate at least one of  $\text{NO}_x$ , HC, and CO contained in the exhaust gases through the first sensor cell electrode to produce a current signal flowing through the solid electrolyte body as a function of concentration of the at least one of  $\text{NO}_x$ , HC, and CO; and

a microcomputer disposed within said connector including a gas concentration determining circuit, an impedance measuring circuit, and a heater control circuit, the gas concentration determining circuit being connected to the first and second sensor cell electrodes and processing the current signal provided by said gas concentration sensor to output a voltage signal as a function of the concentration of the at least one of  $\text{HO}_x$ , HC, and CO to said remote digital signal processor through serial digital signal communication, the impedance measuring circuit measuring an impedance of the sensor

element of said gas concentration sensor, the heater control circuit controlling a power supply to a heater which heats the sensor element based on the measured impedance.

2. ~~16~~ <sup>17</sup> (New) A gas concentration measuring apparatus as in claim ~~16~~ wherein said microcomputer measures a current flowing through the first and second pump cell electrodes of said pump cell and determines a target voltage to be applied to the first and second pump cell electrodes as a function of the measured current.

<sup>17</sup> ~~18.~~ (New) A gas concentration measuring apparatus as in claim ~~16~~ further comprising:

a conductor electrically connecting said gas concentration sensor and said microcomputer for transmission of the current signal from said gas concentration sensor to said microcomputer,

said conductor having a length selected as a function of a level of the current signal outputted from said gas concentration sensor.

~~18. 19.~~ (New) A method for operating a gas concentration sensor having a sensor element and an electrical connector for connection to a remote digital signal processor, said sensor element including a pump cell and a sensor cell, the pump cell being made of a solid electrolyte body and a first and a second pump cell electrode, the first and second pump cell electrodes being responsive to application of voltage to disassociate and pump oxygen molecules contained in exhaust gases of an automotive engine to which said gas concentration sensor is exposed out of said gas concentration sensor, said sensor cell

being made of a solid electrolyte body and a first and a second sensor cell electrode, the first and second sensor cell electrodes being responsive to application of voltage to disassociate at least one of NO<sub>x</sub>, HC, and CO contained in the exhaust gases through the first sensor cell electrode to produce a current signal flowing through the solid electrolyte body as a function of concentration of the at least one of NO<sub>x</sub>, HC, and CO, said method comprising:

providing in said connector a microcomputer including a gas concentration determining circuit, an impedance measuring circuit, and a heater control circuit, the gas concentration determining circuit being connected to the first and second sensor cell electrodes and processing the current signal provided by said gas concentration sensor to output a voltage signal as a function of the concentration of the at least one of HO<sub>x</sub>, HC, and CO to said remote digital signal processor through serial digital signal communication, the impedance measuring circuit measuring an impedance of the sensor element of said gas concentration sensor, the heater control circuit controlling a power supply to a heater which heats the sensor element based on the measured impedance.

5. *19. 20.* (New) A method as in claim *19* wherein said microcomputer measures a current flowing through the first and second pump cell electrodes of said pump cell and determines a target voltage to be applied to the first and second pump cell electrodes as a function of the measured current.

*AND 320. 21.* (New) A method as in claim 19 wherein a gas concentration measuring apparatus as a conductor electrically connects said gas concentration sensor and said microcomputer for transmission of the current signal from said gas concentration sensor to said microcomputer,

said conductor having a length selected as a function of a level of the current signal outputted from said gas concentration sensor.